I CLAIM:

1. A method for generating a reduced state space representation for a model in a compositional state system, the model comprising a selected set of components, each component comprising one or more states and one or more events, the model comprising interactions associated with events, the reduced state space representation being defined with respect to a set of events of interest selected from the events in the set of components the method comprising the following steps:

    a. for each component in the set of components, defining a transitive effect machine for the component such that the states of the transitive effect machine represent the states of the component and the events of the transitive effect machine represent the transitive effects of interactions associated with transitions of the component, the transitive effects being defined relative to the set of components, and the set of events of interest, and

    b. reducing each of the defined transitive effect machines, the reduction including the classification of states within a single transitive effect machine to permit a set of states in the said transitive effect machine to be grouped into a single class when each state in the said set of states is characterized by common properties with respect to the set of events of interest.

2. The method of claim 1, in which the compositional state system supports labelled transition system models.

3. The method of claim 1, in which equivalent effects of transitive interactions for the transitions in the set of components are defined relative to a one of bisimulation or simulation equivalence.

4. The method of claim 1, in which equivalent effects of transitive interactions for the transitions in the set of components are defined relative to a one of observational equivalence or safety equivalence.

5. The method of claim 1, in which the transitive effect machines are represented by BDDs.

6. The method of claim 1, comprising the further step of carrying out an expanding composition of the reduced state representation defined by the set of reduced transitive effect machines.

7. The method of claim 1, comprising the further step of converting the reduced state representations to a labelled transition system representation.

8. A method for generation of a reduced state space representation of a model in a compositional state system, the model comprising a set of components, each component comprising one or more states and one or more events, the model comprising interactions associated with events, the reduced state space representation being defined with respect to a set of events of interest selected from the events in the set of components,

the method comprising the successive generation of a set of reduced transitive effect machines relative to a set of successively defined assumed reduced components, each one of the reduced transitive effect machines comprising classes and events and uniquely corresponding to a component in the set of components and each one of the assumed reduced components uniquely corresponding to a reduced transitive effect machine and being derived from the corresponding component in the set of components and comprising a set of classes into which the states in the said component are grouped.

9. The method of claim 8 in which the generation of each reduced transitive effect machine comprises the steps of

a. generating an intermediate transitive effect machine comprising states and events, the states of the intermediate transitive effect machine representing states of the component uniquely corresponding to the reduced transitive effect machine and the events of the intermediate transitive effect machine representing one or more sets of equivalent effects of transitive interactions,

the equivalent effects of transitive interactions being defined for a pair of states in the component uniquely corresponding to the reduced transitive effect machine, the defined equivalent effects being determined with reference to the set of successively defined assumed reduced components, where equivalent effects represent the transitive effects of interactions associated with each of the said pair of states, on a selected number of assumed reduction components, the transitive effects being defined with respect to the set of events of interest, and

b. generating the reduced transitive effect machine by reducing the states in the intermediate transitive effect machine to classes of states to define the classes in the reduced transitive effect machine and by reducing the events in the intermediate transitive effect machine to define the events in the reduced transitive effect machine.

10. The method of claim 9 in which each defined assumed reduction component is initialized to a defined condition and in which the successive definitions of the assumed reduction component are derived from the corresponding reduced transitive effect machine.

11. The method of claim 9 in which a single step in the successive generation of reduced transitive effect machines is terminated, and a further successive generation step is commenced, where the classes of a reduced transitive effect

machine defined in the single successive generation step are not consistent with the classes in the corresponding assumed reduction component.

12. The method of claim 11 in which the initialization of each assumed reduced component comprises the step of defining each class in the assumed reduced component to include all states in the corresponding component in the state of components.

13. The method of claim 12 in which each step in the successive redefinition of the assumed reduced components comprises defining the classes in each assumed reduced component to be equivalent to the classes in the previously generated corresponding reduced transitive effect machine.

14. The method of claim 9 in which the equivalent effects of transitive interactions for each transition in a component are defined with respect to each of the non-corresponding assumed reduced components.

15. The method of claim 9 in which the equivalent effects of transitive interactions for each transition in the component are defined with respect to defined subsets of the non-corresponding assumed reduced condition.

16. The method of claim 9 in which the equivalent effects of transitive interactions for the corresponding component are merged prior to defining each intermediate reduced transitive effects machine.

17. The method of claim 9 in which the order of generation of intermediate reduced transitive effect machines is arranged in one or more of the following ways

i. the generation of intermediate transitive effect machines uses the assumed reduced component corresponding to the most recently defined reduced transitive effect machines;

ii. a sequential selection of assumed reduced components for use in determining equivalent effects is arranged from the assumed

reduced component with fewest classes to the assumed reduced component with most classes; and

iii. the generation of defined sets of intermediate reduced transitive effect machines is carried out in parallel.

18. The method of claim 9, in which the compositional state system supports labelled transition system models.

19. The method of claim 9, in which equivalent effects of transitive interactions for the transitions in the set of components are defined relative to a one of bisimulation or simulation equivalence.

20. The method of claim 9, in which equivalent effects of transitive interactions for the transitions in the set of components are defined relative to a one of observational equivalence or safety equivalence.

21. The method of claim 9, in which transitive effect machines are represented by BDDs.

22. The method of claim 9, comprising the further step of composing the reduced state representation defined by the set of reduced transitive effect machines.

23. The method of claim 9, comprising the further step of converting the composed reduced state representation to an labelled transition system representation.

24. A method for generating a test sequence for a system, the system being represented by a model having states and events, the method comprising the following steps:

i. composing the model and a test representation to generate a composed test model, the test representation comprising states and events defining a set of test requirements, and comprising one or more acceptance events,

ii. defining a set of transitive effect machines by carrying out the method of claim 1 with respect to the composed test model and a set of events of interest, the set of events of interest comprising one or more of the acceptance events,

iii. defining an input data set for a test sequence generator using the set of transitive effect machines, and

iv. obtaining the test sequence by running the test sequence generator on the input data set.

25. A method for generating a test sequence for a system, the system being represented by a model having states and events, the method comprising the following steps:

i. composing the model and a test representation to generate a composed test model, the test representation comprising states and events defining a set of test requirements, and comprising one or more acceptance events,

ii. defining a set of transitive effect machines by carrying out the method of claim 8 with respect to the composed test model and a set of events of interest, the set of events of interest comprising one or more of the acceptance events,

iii. defining an input data set for a test sequence generator using the set of transitive effect machines, and

iv. obtaining the test sequence by running the test sequence generator on the input data set.

26. A method for generating a test sequence for a system, the system being represented by a model having states and events, the method comprising the following steps:

i. defining a set of events of interest,

ii. composing the model and a test representation to generate a first composed test model, the test representation comprising states and events defining a set of test requirements, and comprising one or more acceptance events,

iii. defining successive sets of transitive effect machines by carrying out the method of claim 1 with respect to successively defined composed test models and successively defined subsets of the set of events of interest, the said subset comprising one or more of the acceptance events, the successive definition of composed test models comprising the composition of the first test model with the output of a previously defined interim test sequence,

iv. defining input data sets for a test sequence generator using the successive sets of transitive effect machines,

v. obtaining a series of interim test sequences by running the test sequence generator on the input data sets, and

vi. defining the test sequence by running the test sequence generator on the series of interim test sequences.

27. A method for generating a test sequence for a system, the system being represented by a model having states and events, the method comprising the following steps:

i. defining a set of events of interest,

ii. composing the model and a test representation to generate a first composed test model, the test representation comprising states and events defining a set of test requirements, and comprising one or more acceptance events,

iii. defining successive sets of transitive effect machines by carrying out the method of claim 8 with respect to successively defined composed test models and successively defined subsets of the set of events of interest, the said subset comprising one or more of the acceptance events, the successive definition of composed test models comprising the composition of the first test model with the output of a previously defined interim test sequence,

iv. defining input data sets for a test sequence generator using the successive sets of transitive effect machines,

v. obtaining a series of interim test sequences by running the test sequence generator on the input data sets, and

vi. defining the test sequence by running the test sequence generator on the series of interim test sequences.

28. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 1.

29. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 8.

30. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 9.

31. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 10.

32. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 11.

33. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 12.

34. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 13.

35. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 24.

36. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 25.

37. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 26.

38. A computer program product comprising a computer usable medium tangibly embodying computer readable program code for carrying out the method of claim 27.

39. A computer system for generating a reduced state space representation for a compositional state model, the model comprising a selected set of components, each component comprising one or more states and one or more events, the model comprising interactions associated with events, the reduced state space representation being defined with respect to a set of events of interest selected from the events in the set of components, the computer system comprising:

program code for defining, for each component in the set of components, a transitive effect machine for the component such that the states of the transitive effect machine represent the states of the component and the events of the transitive effect machine represent the transitive effects of interactions associated with transitions of the component, the transitive effects being defined relative to the set of components, and the set of events of interest, and

program code for reducing each of the defined transitive effect machines, the reduction including the classification of states within a single transitive effect machine to permit a set of states in the said transitive effect machine to be grouped into a single class when each state in the said set of states is characterized by common properties with respect to the set of events of interest.

40. The computer system of claim 39, further comprising means for carrying out an expanding composition of the reduced state representation defined by the set of reduced transitive effect machines.

41. A computer system for generation of a reduced state space representation of a model, the model comprising a set of components, each component comprising one or more states and one or more events, the model comprising interactions associated with events, the reduced state space representation being defined with respect to a set of events of interest selected from the events in the set of components,

the computer system comprising means for the successive generation of a set of reduced transitive effect machines relative to a set of successively defined assumed reduced components, each one of the reduced transitive effect machines comprising classes and events and uniquely corresponding to a component in the set of components and each one of the assumed reduced components uniquely corresponding to a reduced transitive effect machine and being derived from the corresponding component in the set of components and

comprising a set of classes into which the states in the said component are grouped.

42. The computer system of claim 41 in which the means for generation of each reduced transitive effect machine comprises:

program code for generating an intermediate transitive effect machine comprising states and events, the states of the intermediate transitive effect machine representing states of the component uniquely corresponding to the reduced transitive effect machine and the events of the intermediate transitive effect machine representing one or more sets of equivalent effects of transitive interactions,

the equivalent effects of transitive interactions being defined for a pair of states in the component uniquely corresponding to the reduced transitive effect machine, the defined equivalent effects being determined with reference to the set of successively defined assumed reduced components, where equivalent effects represent the transitive effects of interactions associated with each of the said pair of states, on a selected number of assumed reduction components, the transitive effects being defined with respect to the set of events of interest, and

program code for generating the reduced transitive effect machine by reducing the states in the intermediate transitive effect machine to classes of states to define the classes in the reduced transitive effect machine and by reducing the events in the intermediate transitive effect machine to define the events in the reduced transitive effect machine.

43. The computer system of claim 42 comprising program code for initializing each defined assumed reduction component to a defined condition and program code for successively defining assumed reduction components from their corresponding reduced transitive effect machines.

44. The computer system of claim 42 comprising program code for terminating a single step in the successive generation of reduced transitive effect machines and for commencing a further successive generation step, where the classes of a reduced transitive effect machine defined in the single successive generation step are not consistent with the classes in the corresponding assumed reduction component.